

Correlations Between Homeowner Mold Insurance Claims and Weather Databases in Texas

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ABSTRACT

Limiting moisture problems and mold growth in homes requires both controlling moisture levels in interior spaces, and managing water vapor transport and bulk water intrusion in the building envelope, such as infiltration of humid air and the penetration of rainwater into building envelopes. In 2001, the Texas Department of Insurance (TDI) issued a Special Call for Homeowners Mold Experience. This cursory analysis couples that database with key historical weather conditions from the National Climatic Data Center (NCDC) for that same time period to show more humid climate zones in Texas to be more prone to incidences of mold and resulting mold claims. A statistical correlation between higher outdoor dew point temperatures and greater numbers of mold damage claims (per 1000 policyholders) is clearly evident. However, no such clear correlation is evident between precipitation amounts and the number of mold damage claims.

BACKGROUND

Recent research has brought recognition to the infiltration of humid air and the intrusion of rainwater into building envelope cavities as significant and often dominant mechanisms for moisture transport in wall and roof systems (Trechel 2001). Moist air infiltration through a home's envelope can be driven by winds or negative pressurization caused by exhaust fans, unbalanced air distribution, and/or leaky ductwork. In hot and humid climates, colder surfaces in the envelope created by air conditioning the interior can create an elevated relative humidity (RH), or even set up a condensation plane where infiltrating moist air can reach its dew point temperature. For mold to grow, spores must be present along with nutrients under conducive temperature and humidity conditions. Inside or outside the home, mold spores are always present in the air and most common building materials have nutrients to support mold growth on their surfaces. When the RH adjacent to a surface is above 70% RH, the conditions are sufficient for mold growth if the

dry bulb temperature is between 40 and 100 °F (Lstiburek and Carmody 1994). Infiltrating air can raise the relative humidity to that threshold level for limited mold growth on surfaces, or even saturate building cavities for extensive mold colonization. Repeated water intrusions through rain penetration of wall and roof systems or plumbing leaks into building envelopes can produce the same, and often more catastrophic results.

In recent years the insurance industry in Texas has seen a four fold increase in water damage losses with such claims accounting for 60% of all homeowner losses by 2002 (Mills 2005). This crisis led to the implementation of policies with clearly stated mold exclusions with "buy back" provisions at limited mold remediation liability levels for covered water damage in homeowner policies (TDI 2002A).

Those in the insurance field have long recognized the increased risk of homeowner property coverage in areas prone to natural disasters, such as hurricanes along the Gulf Coast, and homeowners living in the affected areas are seeing greater property insurance cost increases than those outside such regions (Yerak 2005). The recent trends in mold coverage are another example of identifying, and even separating out, high risk elements from mainstream homeowner policies and charging more for that additional risk coverage.

In the instance of mold coverage though, the combined insurance industry and individual state commission response has been especially swift and sweeping in states like Texas with dramatic increases in such losses. However, as the understanding of the building science field grows regarding how construction practices, building operations, and climate all factor into mold production, then a more refined approach may emerge that better assigns cost to the leading risk factors. This paper makes an initial, cursory attempt at better understanding the relationship between weather factors and mold claim activity.

MOLD INSURANCE CLAIMS DATABASE

In 2000, the insurance industry first began uniquely coding and separating out mold losses from water damage claims. In 2001, the Texas Department of Insurance (TDI) issued a Special Call for Homeowners Mold Experience for the period January 1, 2000 through December 31, 2001, to the top 5 insurance carriers representing 70% of the residential policies in the state. The policies covered single family (detached and attached) homeowners, but not mobile homeowners, condominium owners, or renters. The database is summarized on the Mold Resources Page of the TDI website (www.tdi.state.tx.us/commish/mold.html). The Mold Data Territory Summary for the period January 1, 2000 through December 31, 2001 is reproduced in Table 1 (TDI 2002B).

The first column of Table 1 identifies a territory from the state insurance benchmark rate system at that time. The territories are broad groupings of contiguous counties, with single county territories established where there is a major city. Table 2 identifies all 254 Texas county assignments to those territories. Figure 1 overlays those territories on the state map of Texas with county boundary outlines in the background. Of particular interest will be the territories near the moisture laden air masses of the Gulf of Mexico. Territory 10 consists of the counties immediately on the coast, with separate territories created for Galveston (Territory 8/Galveston County) and Corpus Christi (Territory 9/ Nueces County), the major cities on the coast. The so-called second tier counties (those one county removed from the coast), with the exception of Houston (Territory 1/Harris County), comprise Territory 11 (TDI 2006).

The fourth column of Table 1 contains the average mold claim cost in that territory. The third column displays the average annual cost per policyholder of all the mold losses in that territory. The sixth column calculates the percentage difference between those average annual costs per policyholder in that territory (third column) versus the statewide average (last row). The fifth column of Table 1 presents the number of mold claims per 1000 insured homeowners in that territory. (Note that some insured homeowners may have multiple policies, i.e., second homes.) It is the number of mold claims (per 1000 insured homeowners) that will be the basis for the correlations to key weather data parameters. The second column identifies sample cities in that territory which serve as the basis for weather data location selections.

WEATHER DATABASE

In hot and humid climates, such as along the Texas coast of the Gulf of Mexico, the water vapor in infiltration air can condense on cool surfaces in building envelopes if those surface temperatures are below the dew point of the outside air. Infrequent or or shorter term exposure of lower temperature surfaces to higher dew point air will not likely result in major mold damage, but if the those conditions are prolonged mold growth can be sustained. Generally, it is recommended that the dew point conditions be averaged over weeks or months when investigating the potential for condensation due to infiltrating air (Trechsel 1994). A 3 month average for dew point temperature is used in this analysis.

The weather database generated for the mold claim correlations encompasses three weather parameters considered relevant for mold development: dry bulb temperature, dew point temperature, and precipitation. Only 16 of the 23 territories in Table 1 had sample cities with weather stations providing data for all three of the selected weather parameters. Table 3 repeats those territories and sample cities from Table 1 in the first and second columns. The third through fifth columns in Table 3 identify the city, site description, and WBAN # for the weather data stations used in the mold claim correlations. Note that Dallas (Territory 2) and Fort Worth (Territory 3) used the same weather data location. Also note that Territory 11 is represented by 2 cities (Victoria and McAllen), as is Territory 15N (Midland and San Angelo).

The source for the weather data used is the National Climatic Data Center (NCDC). The weather data obtained from the NCDC originated from two data sets: the Daily Surface Data set (DSD), containing data for over 19,000 U.S. cities, and the Monthly Surface Data set (MSD), containing monthly aggregated data for nearly 18,000 sites worldwide. Both the DSD and MSD are organized into data files accessible through the NCDC web site (<http://cdo.ncdc.noaa.gov/CDO/dataproduct>). But neither data set provided all three of the needed weather parameters for every weather site, hence the need to use both data sets. The needed parameters were obtained from the MSD set when available, then complemented with the DSD set when needed additional data was not available in the monthly set. When the DSD set was used to generate monthly values, the data was either averaged (average dry bulb temperature and average dew point temperature), or summed (total precipitation). This weather database is provided in Tables 4A-C.

Table 1. TDI Mold Data Territory Summary for 2000 -2001 (TDI 2002B)

Territory	Sample Cities	Average Cost Per Policyholder Per Year	Average Cost Per Claim	# Claims Per 1,000 Insureds	%Territory Cost Above (Below) Statewide Cost
1	Houston	\$292.02	\$40,547	7.2	58.10%
2	Dallas	\$113.59	\$35,995	3.16	-38.50%
3	Fort Worth	\$67.46	\$32,815	2.06	-63.50%
4	Denton	\$49.32	\$34,630	1.42	-73.30%
	Plano				
5	San Antonio	\$119.39	\$33,225	3.59	-35.40%
6	Austin	\$265.50	\$43,200	6.15	43.70%
7	El Paso	\$0.81	\$15,218	0.05	-99.60%
8	Galveston	\$232.24	\$33,203	6.99	25.70%
9	Corpus Christi	\$1,367.95	\$50,169	27.27	640.50%
10	Beaumont, Brownsville,	\$559.25	\$44,988	12.43	202.70%
	Angleton				
11	Orange	\$443.33	\$35,374	12.53	140.00%
	Liberty				
	Victoria, McAllen				
12	Laredo	\$71.57	\$40,917	1.75	-61.30%
	Del Rio, Kerrville				
13	Bryan	\$114.23	\$39,849	2.87	-38.20%
	Temple				
	Georgetown, Round Rock				
14	Tyler, Longview	\$105.54	\$39,029	2.7	-42.90%
	Conroe, Nacogdoches				
	Lufkin, Corsicana, Palestine				
15C	Fort Stockton, Pecos	\$24.12	\$20,969	1.15	-86.90%
	Alpine				
15N	Midland	\$69.25	\$30,728	2.25	-62.50%
	Odessa				
	Big Spring				
	San Angelo				
	Sweetwater				
16C	Waco	\$58.89	\$30,789	1.91	-68.1
	Brownwood, Cleburne				
16N	Abilene	\$62.02	\$27,133	2.29	-66.40%
17	Texarkana, Paris, Denison	\$37.25	\$29,316	1.27	-79.80%
	Greenville				
	Sherman				
18	Lubbock	\$61.22	\$29,266	2.09	-66.90%
	Plainview				
19C	Weatherford	\$100.68	\$37,632	2.68	-45.50%
	Gainesville				
	Mineral Wells				
19N	Wichita Falls	\$63.31	\$27,813	2.28	-65.70%
	Vernon				
20	Amarillo	\$93.71	\$26,520	3.53	-49.30%
999	Texas Statewide	\$184.74	\$38,997	4.74	0.00%

Table 2. County Assignments to Insurance Territories (TDI 2006)

Territory	County	Territory	County	Territory	County	Territory	County	Territory	County
1	Harris	12	Uvalde	14	Newton	16C	Kimble	18	Lamb
2	Dallas	12	Val Verde	14	Panola	16C	Mason	18	Lubbock
3	Tarrant	12	Webb	14	Polk	16C	Menard	18	Lynn
4	Collin	12	Zapata	14	Rusk	16C	Mills	18	Motley
4	Denton	12	Zavala	14	Sabine	16C	Somervell	18	Parmer
4	Rockwall	13	Austin	14	San Augustine	16C	McCulloch	18	Scurry
5	Bexar	13	Bastrop	14	San Jacinto	16C	McLennan	18	Stonewall
6	Travis	13	Bell	14	Shelby	16N	Callahan	18	Swisher
7	El Paso	13	Blanco	14	Smith	16N	Coleman	18	Terry
8	Galveston	13	Brazos	14	Trinity	16N	Concho	18	Yoakum
9	Nueces	13	Burleson	14	Tyler	16N	Runnels	19C	Cooke
10	Aransas	13	Burnet	14	Walker	16N	Taylor	19C	Jack
10	Brazoria	13	Caldwell	14	Waller	17	Bowie	19C	Montague
10	Calhoun	13	Colorado	15C	Brewster	17	Camp	19C	Palo Pinto
10	Cameron	13	Comal	15C	Crockett	17	Cass	19C	Parker
10	Chambers	13	Coryell	15C	Culberson	17	Delta	19C	Stephens
10	Jefferson	13	DeWitt	15C	Hudspeth	17	Fannin	19C	Wise
10	Kenedy	13	Falls	15C	Jeff Davis	17	Franklin	19C	Young
10	Kleberg	13	Fayette	15C	Loving	17	Grayson	19N	Archer
10	Matagorda	13	Gillespie	15C	Pecos	17	Harrison	19N	Baylor
10	Refugio	13	Gonzales	15C	Presidio	17	Hopkins	19N	Clay
10	San Patricio	13	Guadalupe	15C	Reeves	17	Hunt	19N	Foard
10	Willacy	13	Hays	15C	Schleicher	17	Kaufman	19N	Hardeman
11	Bee	13	Karnes	15C	Sutton	17	Lamar	19N	Haskell
11	Brooks	13	Kendall	15C	Terrell	17	Marion	19N	Jones
11	Fort Bend	13	Lampasas	15N	Andrews	17	Morris	19N	Knox
11	Goliad	13	Lavaca	15N	Coke	17	Rains	19N	Shackelford
11	Hardin	13	Lee	15N	Crane	17	Red River	19N	Throckmorton
11	Hidalgo	13	Llano	15N	Ector	17	Titus	19N	Wichita
11	Jackson	13	Milam	15N	Glasscock	17	Upshur	19N	Wilbarger
11	Jim Wells	13	Robertson	15N	Howard	17	Van Zandt	20	Armstrong
11	Liberty	13	San Saba	15N	Irion	17	Wood	20	Carson
11	Live Oak	13	Washington	15N	Martin	18	Bailey	20	Collingsworth
11	Orange	13	Williamson	15N	Midland	18	Borden	20	Dallam
11	Victoria	13	Wilson	15N	Mitchell	18	Briscoe	20	Deaf Smith
11	Wharton	14	Anderson	15N	Nolan	18	Castro	20	Donley
12	Atascosa	14	Angelina	15N	Reagan	18	Childress	20	Gray
12	Bandera	14	Cherokee	15N	Sterling	18	Cochran	20	Hansford
12	Dimmit	14	Ellis	15N	Tom Green	18	Cottle	20	Hartley
12	Duval	14	Freestone	15N	Upton	18	Crosby	20	Hemphill
12	Edwards	14	Gregg	15N	Ward	18	Dawson	20	Hutchinson
12	Frio	14	Grimes	15N	Winkler	18	Dickens	20	Lipscomb
12	Jim Hogg	14	Henderson	16C	Bosque	18	Fisher	20	Moore
12	Kerr	14	Houston	16C	Brown	18	Floyd	20	Ochiltree
12	Kinney	14	Jasper	16C	Comanche	18	Gaines	20	Oldham
12	La Salle	14	Leon	16C	Eastland	18	Garza	20	Potter
12	Maverick	14	Limestone	16C	Erath	18	Hale	20	Randall
12	McMullen	14	Madison	16C	Hamilton	18	Hall	20	Roberts
12	Medina	14	Montgomery	16C	Hill	18	Hockley	20	Sherman
12	Real	14	Nacogdoches	16C	Hood	18	Kent	20	Wheeler
12	Starr	14	Navarro	16C	Johnson	18	King	Total 254 Counties	

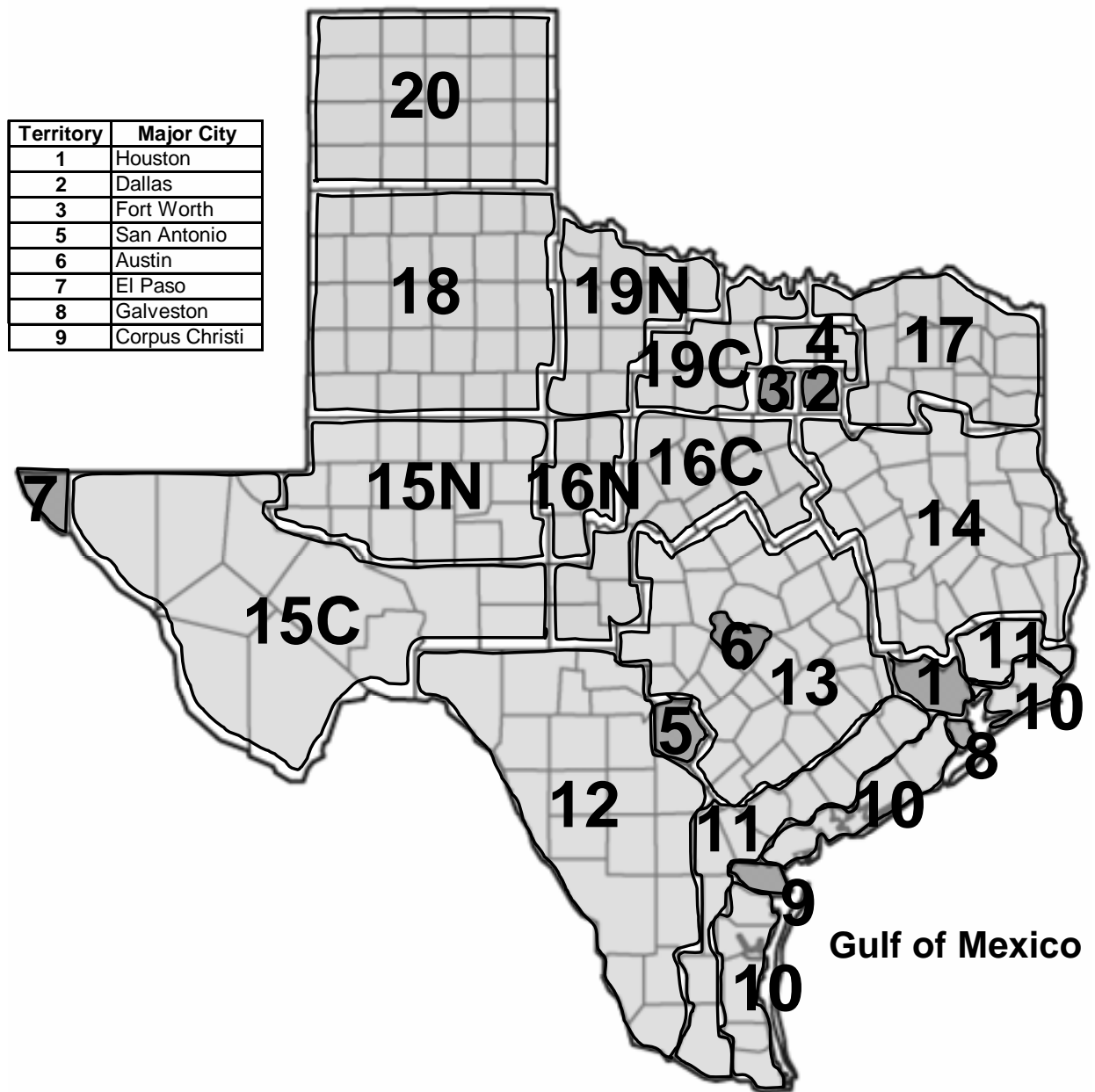


Figure 1. Texas County and Insurance Territory Map

Note the light gray shaded areas are larger territory groupings of counties and the darker gray shaded areas are single counties with major cities shown here in the inserted table.

Table 3. NCDC Weather Data Locations by TDI Mold Claim Territory

TDI Territory	TDI Sample Cities	NCDC City with Required Data*	NCDC Weather Station Description	NCDC WBAN #
1	Houston	Houston	Houston Bush Intercontinental Airport	12960
2	Dallas	Dallas/Fort Worth	Dallas-Fort Worth International Airport	03927
3	Fort Worth	Dallas/Fort Worth	Dallas-Fort Worth International Airport	03927
4	Denton	None Available		
	Plano			
5	San Antonio	San Antonio	San Antonio International Airport	12921
6	Austin	Austin	Austin Mueller Municipal Airport	13958
7	El Paso	El Paso	El Paso International Airport	23044
8	Galveston	None Available		
9	Corpus Christi	Corpus Christi	Corpus Christi International Airport	12924
10	Beaumont, Brownsville, Angleton	Brownsville	Brownsville Padre Island International Airport	12919
11	Orange	Victoria	Victoria Regional Airport	12912
	Liberty	McAllen	McAllen Miller International Airport	12959
	Victoria, McAllen			
12	Laredo	Del Rio	Del Rio International Airport	22010
	Del Rio, Kerrville			
13	Bryan	None Available		
	Temple			
	Georgetown, Round Rock			
14	Tyler, Longview	None Available		
	Conroe, Nacogdoches			
	Lufkin, Corsicana, Palestine			
15C	Fort Stockton, Pecos	None Available		
	Alpine			
15N	Midland	Midland	Midland International Airport	23023
	Odessa	San Angelo	San Angelo Mathis Field	23034
	Big Spring			
	San Angelo			
	Sweetwater			
16C	Waco	Waco	Waco Regional Airport	13959
	Brownwood, Cleburne			
16N	Abilene	Abilene	Abilene Regional Airport	13962
17	Texarkana, Paris, Denison	None Available		
	Greenville			
	Sherman			
18	Lubbock	Lubbock	Lubbock International Airport	23042
	Plainview			
19C	Weatherford	None Available		
	Gainesville			
	Mineral Wells			
19N	Wichita Falls	Wichita Falls	Wichita Falls Municipal Airport	13966
	Vernon			
20	Amarillo	Amarillo	Amarillo International Airport	23047

***Required Minimum Weather Data:** Monthly Average Dry Bulb Temperature
Monthly Average Dew Point Temperature
Monthly Total Precipitation
from January 2000 through December 2001

Table 4A. Weather Data Summary for 2000-2001

Year	Month	ABILENE			AMARILLO			AUSTIN			BROWNSVILLE			CORPUS CHRISTI			DALLAS / FT. WORTH		
		Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches
2000	Jan	49.48	28.27	0.17	39.68	19.95	0.24	55.65	41.03	2.85	66.00	57.47	0.85	62.71	53.61	0.51	50.60	34.66	1.59
2000	Feb	56.03	34.47	0.44	47.41	22.87	0.04	62.28	49.70	1.75	70.30	62.06	0.19	67.72	59.09	0.61	57.30	42.05	3.30
2000	Mar	60.48	40.50	0.88	49.45	33.53	4.14	66.55	54.82	1.14	74.40	65.85	2.89	71.48	63.83	3.68	60.90	48.03	2.92
2000	Apr	67.93	45.79	0.64	58.13	38.16	0.43	70.60	57.36	2.40	75.60	65.99	0.39	73.40	64.05	1.02	65.20	51.95	4.28
2000	May	79.65	57.00	2.59	69.97	44.15	1.14	79.29	68.96	3.25	82.50	73.09	1.87	80.13	73.58	4.80	76.60	64.27	3.17
2000	Jun	78.53	65.82	5.48	72.20	59.60	5.54	81.87	70.22	5.27	84.20	73.74	0.85	82.17	74.08	2.61	80.60	68.77	5.93
2000	Jul	85.94	60.43	0.01	80.32	58.52	0.16	86.97	67.58	1.87	85.70	72.70	0.28	85.10	73.22	0.01	87.30	66.38	0.00
2000	Aug	87.10	57.29	0.00	82.06	52.34	0.29	87.39	68.25	0.13	84.00	74.18	4.29	84.97	73.07	0.96	90.20	63.31	0.00
2000	Sep	78.70	50.58	1.08	74.00	44.01	0.03	81.77	61.16	1.76	82.60	70.10	0.66	81.93	68.03	2.03	80.40	58.37	0.16
2000	Oct	67.23	53.87	7.01	59.97	46.10	3.95	71.68	62.26	6.03	74.80	66.97	2.71	74.13	66.22	1.90	69.60	56.29	4.38
2000	Nov	48.30	39.52	2.51	39.83	27.09	0.96	56.17	48.95	7.95	68.50	59.58	0.41	63.80	56.46	2.27	49.80	41.98	6.95
2000	Dec	39.74	28.88	0.91	33.35	19.80	1.47	45.68	35.77	2.87	57.20	49.51	1.10	53.55	44.58	1.68	39.40	31.18	3.57
2001	Jan	42.03	31.46	1.07	35.03	26.01	1.67	48.58	38.99	2.72	59.50	52.90	0.48	54.97	47.31	1.74	42.60	35.24	2.44
2001	Feb	48.61	39.07	2.70	41.43	30.16	0.93	56.39	47.12	1.41	67.50	61.46	1.43	63.89	55.99	0.72	50.10	42.33	6.17
2001	Mar	51.42	40.62	1.92	45.29	34.90	3.96	55.16	45.56	5.51	66.90	57.73	0.36	61.68	52.57	2.41	51.80	43.55	5.27
2001	Apr	64.27	53.18	0.57	61.27	38.73	0.49	71.00	61.31	0.50	78.00	68.71	1.10	75.10	65.57	0.12	67.80	57.14	0.89
2001	May	74.10	58.78	3.63	65.42	52.28	3.05	76.68	65.11	3.27	80.60	71.82	0.49	78.13	69.09	1.55	74.20	63.54	5.58
2001	Jun	81.90	61.83	1.38	76.77	54.40	1.99	82.87	68.84	0.85	85.70	75.34	2.21	83.03	72.95	4.88	80.20	67.52	1.28
2001	Jul	87.77	61.93	0.03	84.16	56.15	0.04	87.29	69.43	0.34	85.70	75.70	1.81	84.65	74.10	1.82	86.70	71.39	3.85
2001	Aug	83.61	63.03	3.39	78.97	57.96	1.39	86.52	69.56	9.48	86.50	75.69	1.80	84.90	74.37	7.83	84.90	68.95	2.72
2001	Sep	74.63	59.70	2.32	70.60	53.00	3.03	77.43	65.93	1.71	81.70	73.56	3.25	80.27	70.96	6.78	74.60	64.99	3.72
2001	Oct	65.68	46.87	0.49	60.42	37.04	0.05	68.42	56.69	2.46	76.30	66.08	0.36	73.58	64.42	2.47	65.00	52.43	1.86
2001	Nov	58.67	45.99	3.39	51.07	37.55	1.86	63.07	53.79	10.00	70.40	60.98	2.42	67.37	60.78	7.44	59.70	49.52	1.11
2001	Dec	48.06	33.57	0.98	40.65	22.17	0.23	54.00	44.57	4.62	64.40	55.84	1.02	60.29	53.10	1.66	49.40	37.38	3.24
2000	Jun	78.53	65.82		72.20	59.60		81.87	70.22		84.20	73.74		82.17	74.08		80.60	68.77	
2000	Jul	85.94	60.43		80.32	58.52		86.97	67.58		85.70	72.70		85.10	73.22		87.30	66.38	
2000	Aug	87.10	57.29		82.06	52.34		87.39	68.25		84.00	74.18		84.97	73.07		90.20	63.31	
2001	Jun	81.90	61.83		76.77	54.40		82.87	68.84		85.70	75.34		83.03	72.95		80.20	67.52	
2001	Jul	87.77	61.93		84.16	56.15		87.29	69.43		85.70	75.70		84.65	74.10		86.70	71.39	
2001	Aug	83.61	63.03		78.97	57.96		86.52	69.56		86.50	75.69		84.90	74.37		84.90	68.95	
	Average	84.18	61.70		79.13	56.49		85.52	68.97		85.30	74.56		84.15	73.63		85.03	67.72	
2000	2 Year																		
2001	Total			43.59			37.08			80.14			33.22			61.50			74.38

Table 4B. Weather Data Summary for 2000-2001

Year	Month	DEL RIO			EL PASO			HOUSTON			LUBBOCK			MCALLEN			MIDLAND		
		Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches
2000	Jan	56.71	36.08	0.03	49.70	24.66	0.00	56.50	44.97	1.25	43.00	21.62	0.00	66.58	53.52	0.52	47.52	24.93	0.61
2000	Feb	63.69	45.89	0.94	53.90	26.39	0.03	61.70	52.55	2.32	50.40	24.28	0.05	71.59	59.21	0.46	55.62	27.43	0.00
2000	Mar	69.55	49.28	0.28	57.10	26.54	0.06	66.40	58.31	1.35	53.70	34.05	2.78	75.55	63.18	1.40	59.29	34.35	0.76
2000	Apr	75.10	53.16	0.90	68.30	33.10	0.28	67.90	59.31	5.52	62.10	39.31	1.67	77.60	63.78	0.60	67.63	37.40	0.19
2000	May	83.68	64.08	1.03	79.00	34.09	0.00	78.10	70.53	12.35	74.70	46.47	0.78	84.55	71.45	0.04	78.97	48.50	1.05
2000	Jun	84.07	68.54	4.38	80.20	52.70	2.45	81.40	71.96	3.29	74.00	61.90	8.48	84.67	72.35	3.45	78.93	62.88	3.14
2000	Jul	89.97	62.77	0.65	84.00	54.07	1.59	85.20	69.66	0.64	80.50	61.03	2.06	88.55	69.88	1.41	85.65	55.02	0.24
2000	Aug	88.77	64.07	0.11	81.50	52.99	0.70	84.80	70.64	2.11	81.30	55.75	0.01	86.16	72.06	2.95	83.39	54.78	0.06
2000	Sep	83.23	57.74	1.32	78.60	44.14	0.00	79.40	64.51	4.34	74.60	45.33	0.00	83.43	67.79	2.69	78.07	46.17	0.00
2000	Oct	70.26	61.27	5.00	62.50	43.10	0.82	70.90	62.24	3.27	62.30	49.06	3.27	74.97	66.64	2.80	64.45	50.97	2.39
2000	Nov	56.37	47.83	2.82	47.60	28.23	1.06	57.60	50.59	8.50	43.40	32.14	1.25	68.40	57.67	1.48	47.17	35.35	0.88
2000	Dec	48.19	36.61	0.51	44.00	23.42	0.42	47.60	39.15	2.69	35.10	23.08	0.92	56.39	47.47	1.14	40.65	26.53	0.33
2001	Jan	50.58	40.13	1.08	41.80	24.34	0.06	49.30	42.23	4.25	36.80	28.73	1.46	59.35	49.75	0.44	41.77	29.78	0.69
2001	Feb	58.29	47.48	0.54	50.10	23.82	0.24	59.30	52.16	0.82	44.40	33.56	0.51	67.75	58.69	1.44	48.75	37.38	1.24
2001	Mar	60.48	47.15	0.90	56.30	27.25	0.40	56.40	48.39	7.97	48.30	37.25	2.45	67.68	55.93	0.49	52.16	38.08	0.78
2001	Apr	74.63	58.91	0.22	65.50	27.27	0.00	71.70	64.22	2.00	64.30	40.64	0.38	79.50	67.53	0.13	67.07	44.65	0.00
2001	May	81.32	61.50	1.33	76.00	33.41	0.18	75.90	67.57	3.53	70.10	52.80	4.20	82.55	69.71	0.58	76.23	49.27	1.14
2001	Jun	88.13	63.92	0.00	83.20	43.21	0.30	80.50	71.16	19.21	80.70	53.95	0.47	87.07	72.10	3.42	83.87	54.57	0.01
2001	Jul	89.42	64.28	0.13	84.30	55.43	0.36	83.60	73.99	2.05	85.30	57.75	0.60	86.77	71.94	2.54	86.74	56.64	0.00
2001	Aug	88.61	65.49	0.35	81.00	55.39	1.72	83.50	73.37	4.83	79.70	60.39	1.11	86.48	72.78	5.26	82.19	60.53	3.44
2001	Sep	80.03	63.18	2.24	76.80	48.08	0.30	77.00	68.40	8.82	71.90	54.19	0.85	81.63	71.38	4.47	75.27	56.18	0.95
2001	Oct	71.61	53.52	0.43	67.60	36.17	0.00	66.90	58.44	8.95	61.60	39.43	0.02	76.52	63.09	0.10	66.19	43.94	0.03
2001	Nov	63.47	50.74	1.12	54.70	36.29	0.60	63.40	55.58	2.58	52.50	40.12	3.37	70.23	58.58	4.19	54.63	41.28	1.47
2001	Dec	54.39	39.94	0.35	42.70	20.24	0.13	56.00	48.03	6.18	42.50	25.44	0.13	63.10	52.83	1.27	45.03	27.72	0.10
2000	Jun	84.07	68.54		80.20	52.70		81.40	71.96		74.00	61.90		84.67	72.35		78.93	62.88	
2000	Jul	89.97	62.77		84.00	54.07		85.20	69.66		80.50	61.03		88.55	69.88		85.65	55.02	
2000	Aug	88.77	64.07		81.50	52.99		84.80	70.64		81.30	55.75		86.16	72.06		83.39	54.78	
2001	Jun	88.13	63.92		83.20	43.21		80.50	71.16		80.70	53.95		87.07	72.10		83.87	54.57	
2001	Jul	89.42	64.28		84.30	55.43		83.60	73.99		85.30	57.75		86.77	71.94		86.74	56.64	
2001	Aug	88.61	65.49		81.00	55.39		83.50	73.37		79.70	60.39		86.48	72.78		82.19	60.53	
Average		88.18	64.83		82.37	52.34		83.19	71.80		80.28	58.47		86.63	71.85		83.48	57.39	
2000	2 Year																		
2001	Total	26.66			11.70			118.82			36.82			43.27			19.50		

Table 4C. Weather Data Summary for 2000-2001

Year	Month	SAN ANGELO			SAN ANTONIO			VICTORIA			WACO			WICHITA FALLS		
		Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches	Mean DB Temp	Mean DP Temp	Precip inches
2000	Jan	51.06	29.70	0.08	55.55	40.44	1.40	59.65	48.42	3.73	51.52	38.92	2.05	45.06	30.33	0.48
2000	Feb	57.76	35.47	0.23	62.86	48.50	2.20	64.93	55.22	0.69	58.03	47.92	4.54	53.21	36.20	1.20
2000	Mar	63.23	40.21	0.77	67.19	54.40	0.91	69.26	60.29	2.16	62.23	53.00	1.60	56.32	44.36	2.51
2000	Apr	70.23	47.41	0.57	70.93	55.89	1.22	70.97	60.68	2.96	66.73	55.89	2.82	62.90	49.30	2.81
2000	May	81.35	58.37	2.21	78.81	67.58	3.59	79.48	72.22	7.88	76.94	67.44	4.95	77.16	59.32	1.33
2000	Jun	80.37	66.14	3.44	81.23	69.97	7.61	82.27	73.38	4.42	80.33	71.41	7.60	78.97	66.73	3.63
2000	Jul	87.32	59.50	0.02	86.10	66.24	0.34	85.77	71.45	0.88	86.23	66.55	0.82	87.23	64.53	0.70
2000	Aug	86.00	58.42	0.00	86.55	66.74	0.16	85.74	72.00	0.94	87.90	66.53	0.05	90.58	59.84	0.00
2000	Sep	78.70	53.31	0.58	81.17	60.34	2.65	81.50	65.66	1.47	79.83	59.91	1.11	79.50	50.43	0.07
2000	Oct	66.71	55.83	3.61	71.26	62.85	5.62	73.03	64.67	4.49	71.35	59.42	4.57	67.81	53.09	6.38
2000	Nov	49.30	42.14	3.08	57.13	50.49	8.58	60.30	53.98	5.21	52.77	45.66	7.76	46.80	37.49	5.16
2000	Dec	42.87	31.68	0.60	46.61	37.41	1.57	50.13	41.88	1.93	42.00	32.74	2.65	36.71	26.75	1.27
2001	Jan	43.48	33.48	1.29	49.42	40.10	2.85	51.90	44.19	2.60	45.39	37.28	2.90	40.68	31.68	1.55
2001	Feb	50.75	42.59	2.17	57.71	50.08	0.70	61.21	53.40	0.44	53.21	45.45	2.53	45.00	37.07	3.51
2001	Mar	52.58	42.24	1.26	56.81	47.77	2.77	58.39	50.55	3.75	53.23	44.97	4.45	49.94	40.40	0.79
2001	Apr	67.43	53.32	0.82	71.00	62.43	2.29	72.70	64.33	0.17	69.53	58.89	0.66	65.97	53.45	1.20
2001	May	75.87	58.55	2.51	76.52	66.55	2.48	77.58	68.63	6.01	75.81	64.28	3.54	73.52	59.93	3.55
2001	Jun	83.90	61.62	0.26	82.67	68.82	3.39	82.60	72.07	0.42	81.53	68.18	1.76	81.70	63.36	0.00
2001	Jul	87.55	61.91	0.57	85.65	70.31	0.50	85.39	73.00	1.20	88.35	69.29	0.24	90.23	65.11	0.00
2001	Aug	83.35	64.26	3.67	85.71	69.81	7.83	84.52	73.15	8.97	86.71	68.53	4.85	85.55	65.61	4.22
2001	Sep	74.70	60.05	0.89	77.07	65.69	4.05	78.13	69.81	7.06	76.50	65.02	2.22	75.37	59.98	0.49
2001	Oct	66.00	47.15	1.48	68.13	57.65	2.06	69.90	61.25	4.81	66.13	53.79	2.89	64.65	47.15	0.57
2001	Nov	58.53	45.00	3.46	63.10	53.92	4.37	64.53	57.83	3.82	60.83	51.35	5.63	57.83	45.04	1.13
2001	Dec	47.84	34.44	0.14	54.00	43.28	3.43	57.68	50.72	3.52	51.23	42.07	4.03	45.87	31.17	1.10
2000	Jun	80.37	66.14		81.23	69.97		82.27	73.38		80.33	71.41		78.97	66.73	
2000	Jul	87.32	59.50		86.10	66.24		85.77	71.45		86.23	66.55		87.23	64.53	
2000	Aug	86.00	58.42		86.55	66.74		85.74	72.00		87.90	66.53		90.58	59.84	
2001	Jun	83.90	61.62		82.67	68.82		82.60	72.07		81.53	68.18		81.70	63.36	
2001	Jul	87.55	61.91		85.65	70.31		85.39	73.00		88.35	69.29		90.23	65.11	
2001	Aug	83.35	64.26		85.71	69.81		84.52	73.15		86.71	68.53		85.55	65.61	
Average		84.78	61.95		84.68	68.64		84.40	72.50		85.22	68.40		85.77	64.19	
2000	2 Year															
2001	Total			33.71			72.57			79.53			76.22			43.65

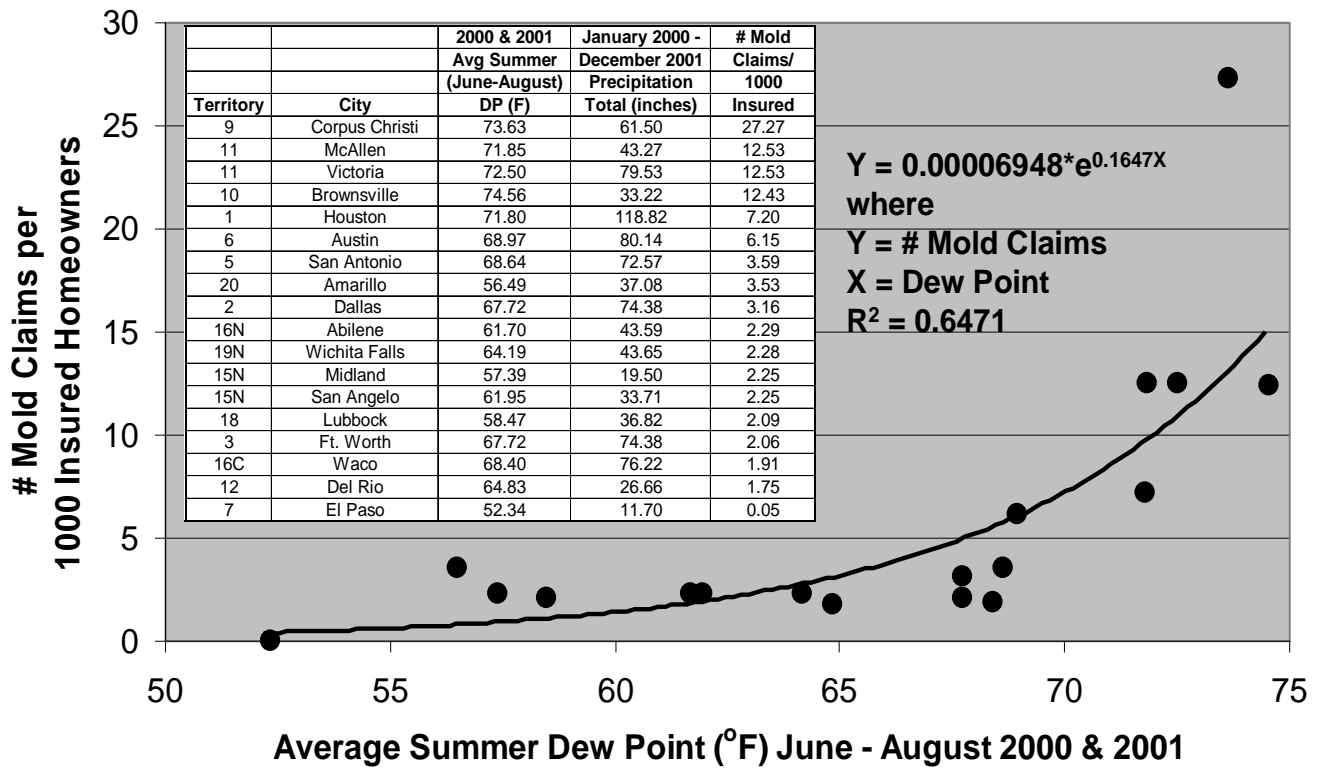


Figure 2A. Mold Claims and Average Dew Point Temperature Correlation

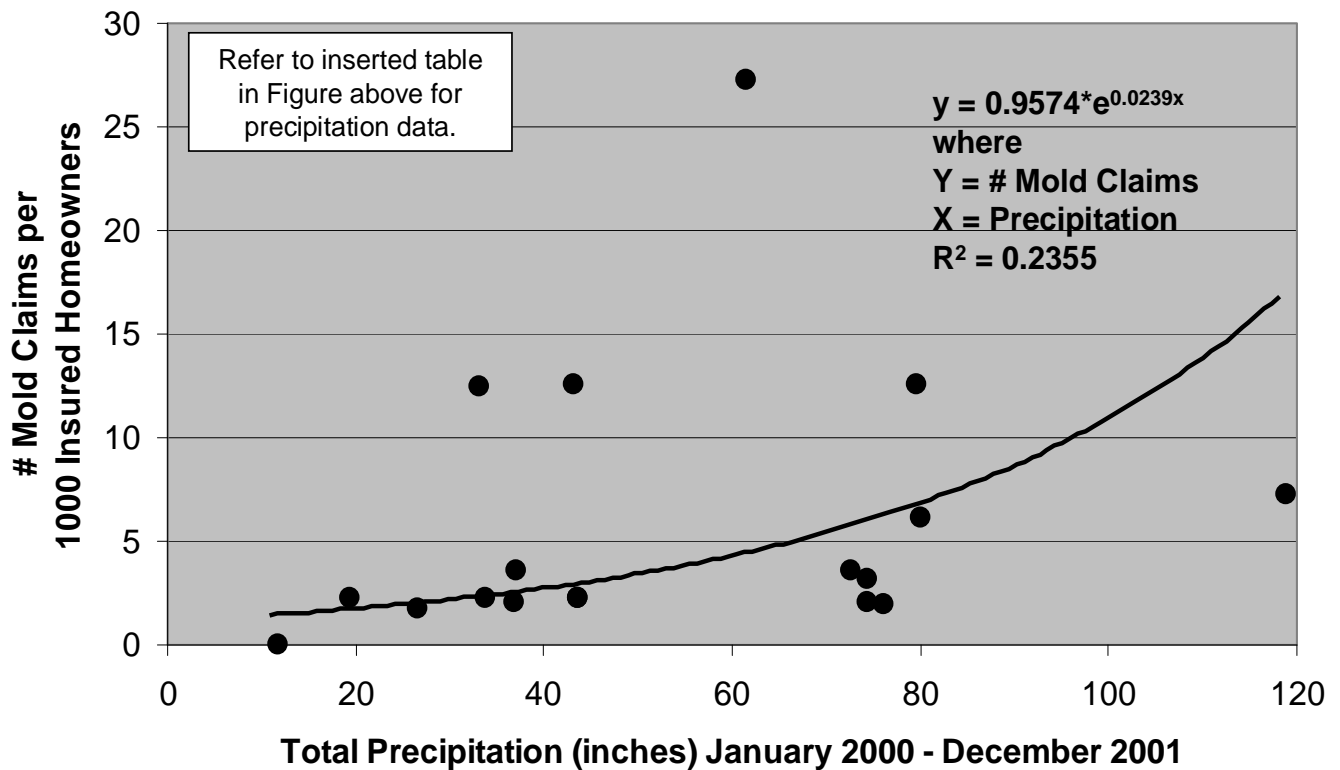


Figure 2B. Mold Claims and Total Precipitation Correlation

MOLD AND WEATHER CORRELATIONS

Figures 2A and 2B plot the # of mold claims per 1000 insured homeowners versus the average dew point temperature (for the summer months of June through August) and total precipitation, respectively, for the combined years of 2000 through 2001. Note that the dry bulb temperature data was not plotted because average summer data for all cities were in the range sufficient for mold growth.

As discussed before, for sustained mold growth, the average moisture level at a building surface must be fairly high, generally 70% RH or greater, for weeks or months. At a 75 °F dry bulb temperature, which is typical of a residential air conditioning setpoint, 70% RH is equivalent to a dew point temperature of 64.5 °F. In hot and humid climates, where average outdoor monthly dew point temperatures during the summer reach 64.5 °F or higher, infiltrating air can generate 70% and higher RH to sustain mold growth on surfaces cooled to 75 °F in building envelopes. Per Figure 2A, all the territories that exhibit greater than the statewide average of 4.74 mold claims per 1000 insured homeowners shown in Table 1, also display the highest average summer dew point temperatures of 69 °F or greater, sufficient to create the mold growth conditions above. The highest mold claim and dew point Territories of 1, 9, 10, and 11 are the counties and cities along the Gulf coast. Most of those same Territories -- 1, 9, and 10 -- also experience some of the highest average costs per mold claim, well above the statewide average of \$38,997 shown in Table 1. A simple exponential equation was applied to the data in Figure 2A to relate the # of mold claims to the dew point temperature. The resulting curve fit correlation displayed in Figure 2A achieved an R^2 of about 0.65.

Per Figure 2B though, no such trend of increasing mold claims with precipitation is seen among the scatter of data points. A review of 2000 - 2001 weather events (NWS 2001 and 2002) for the Texas Gulf coast revealed a few major weather events, including a record breaking heat wave in 2000 and a tropical storm producing large rainfall in 2001 (see Houston June 2001 precipitation in Table 4B), but no hurricane activity that might have triggered large numbers of water damage claims in this two year period. The same simple exponential equation form resulted in a much poorer correlation of the # of mold claims and the precipitation amounts in Figure 2B with an R^2 of about 0.24.

CONCLUSIONS

This cursory analysis couples information on claims from the Texas Department of Insurance (TDI) Special Call on Homeowners Mold Experience with key historical weather conditions from the National Climatic Data Center (NCDC) for the same time period to show more humid territories along the Gulf coast of Texas as more prone to incidences of mold and resulting mold claims. A statistical correlation between higher outdoor dew point temperatures and greater numbers of mold damage claims (per 1000 policyholders) is clearly evident. However, no such clear correlation is evident between precipitation amounts and the number of mold damage claims.

These cursory conclusions though must be tempered by several other considerations noted by TDI (TDI 2006). First, "mold per se was not a covered peril" under a homeowner policy. For a homeowner to be covered, the mold "had to have resulted from a covered peril, such as water damage from say a burst pipe". So supposedly the mere presence of mold, without a preceding covered cause, would not produce a claim. Second, the TDI noted dramatic differences in "claims consciousness" in certain territories that pre-existed the dramatic rise in mold claims. TDI specifically cited Corpus Christi, where slab/foundation water seepage "claims were rampant". Coincidentally, that Territory 9 was also "number one on the mold hit parade". Third, and final, the TDI data consisted of "mold claims reported in 2000 and 2001", which "might have arisen out of events that had occurred years earlier".

Notwithstanding all these other considerations, the consistent trend in mold claim increases above the statewide average seen in multiple territories with higher sustained outdoor dew point temperatures is worthy of strong consideration as well. The infiltration of moisture laden outside air and the formation of high %RH/condensation planes provide a building science basis for mold production in the envelopes of houses. If nothing else, this phenomena could accelerate and worsen a mold situation initiated by a preceding covered water damage event.

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